ANTIBACTERIAL EFFECT OF PENICILLIN AND STREPTOMYCIN ON YEASTS AND SPORE FORMING FOOD SPOILAGE ORGANISMS

BY

SZE LU HANG

B. S., Wu-Han University, China, 1940

M. S., University of Illinois, 1946

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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R. UNIV. BIBLIOTHEEK LEIDEN

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Discovery of penicillin stimulated many investigations on the existence of other antibiotics and their action not only on pathogenic bacteria but on non- pathogenic micro-organisms of interest in the industries. Different kinds of antibiotics, methods of manufacture, mechanism of the effect on bacteria and the uses of antibiotics have been studied in detail but much less work has been done on the possible effect of antibiotics on non- pathogenic microorganisms. It was decided to study the effect of the antibiotic substances on non- pathogenic yeasts of interest mainly in the fermentation industries and on a few food spoilage bacteria.

Many antiseptics have been studied for their action on yeasts. Franz (2) found 1.2% phenol destroyed them and 3.5% chloral hydrate decreased their activity. Salicylic acid acted more strongly than benzoic acid. Leghance (4) found that quinone increased oxygen consumption of yeast cells and lowered multiplication and increased mortality. Tanner (9) stated Gram positive yeasts were destroyed by gentian violet while Gram negative yeasts were not. Rasonnon (6) found chlorine compounds had the strongest bactericidal value for beer yeast, *Saccharomyces pastorianus, Torula willia, Mycoderma cerevisiae,* cranberry yeast, *Oidium lactis,* beer sarcina, etc. Na_2CO_3, NaOH, CaO, NaOCl, KOCl, NH_4F, $Ca(HSO_3)2$, $NaHSO_4$, $KHSO_4$, $Na_2S_2O_3$, formalin, Chloramine and activicin were effective at various concentrations. Higher alcohols have been tested on yeasts by Segel (7) with toxic action more, when the positions of alcohol was higher in the homologous series. Berand (1) growing beer yeast and wine yeast in medium containing low concentrations of NaF found the new cells formed were smaller. Nulson (5) found that sulfanilamide in the presence

of pantothenic acid or β-alanine inhibited the growth of yeast one third of the normal amounts. Stokes (7) reported hemipyocyanine was much more inhibitory for yeasts than bacteria. Pyocyanase inhibited the growth of yeast at higher dilutions than the pyocyanine but was not as active as hemipyocyanine. Recently, Grey (3) reported tyrothricin was extremely effective on beer sarcina; *Saccharomyces cerevisiae* could not withstand 5mg. of tyrothricin for three hours incubation at 37°C. per billion cells.

In the present investigation the antibiotic effect of penicillin and streptomycin was studied on seven yeasts on a 1% dextrose 0.3% yeast extract, 0.5% tryptone medium. The series dilution method, the penicylinder method and the paper disc method were employed. By the series dilution and the penicylinder methods, none of the yeasts were found to be inhibited with 100 units of penicillin per ml. up to 6000 units per ml. Streptomycin, in general, had no effect on the yeasts tested, such as *Saccharomyces ellipsoideus, Mycoderma cerevisiae, Torula spherica, Zygosaccharomyces priorianus, Hansenula anomala, Debaromyces globosus* and *Schizosaccharomyces pombe* when tested by the series dilution method and the paper disc method. Some inhibition was observed when few yeast cells were present. A 1: 1400 dilution of *Schizosaccharomyces pombe,* a 1: 200,00 dilution of *Hansenula anomala* and a 1: 100,000 dilution of *Saccharomyces ellipsoideus, Torula spherica, Zygosaccharomyces priorianus* and *Debaromyces globosus* were inhibited by 100 units of streptomycin per ml. *Saccharomyces ellipsoideus, Zygosaccharomyces priorianus, Hansenula anomala, Debaromyces globosus* and *Schizosaccharomyces pombe* at 1: 1,000,000 dilution were inhibited with 200 units of streptomycin per ml. These were tested by the agar streak method. The size of the yeast cells which might not allow the penetration of the antibiotic substances is a possible explanation for these results.

Six strains of *Clostridium botulinum* of three types were

tested on thioglycollate medium with penicillin and streptomycin by the series dilution method, the penicylinder method and the paper disc method under anaerobic conditions. Penicillin and streptomycin did not inhibit these organisms.

Both penicilin and streptomycin inhibited *Bacillus sterothermophilus*. Penicillin was effective in a range of 0.8 to 0.9 units per ml. and 6 units of streptomycin was effective.

Clostridium nigrificans and *Clostridium thermosaccharolyticum* were tested with penicillin and streptomycin. These tests were not successful because the growth of the former did not give even distribution of black spots on the agar plate with sulfite medium and the latter did not grow very well in the laboratory.

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